MaxLite®

A NEW WAVE OF LIGHT

IMPACTS OF LATEST UPDATES TO ENERGY STAR® TITLE 24 & TITLE 20 ON LIGHT SOURCES & LUMINAIRES

MaxLite UNIVERSITY

IMPACTS OF LATEST UPDATES TO ENERGY STAR® TITLE 24 & TITLE 20 ON LIGHT SOURCES & LUMINAIRES

Presented by: Chris Primous - VP of National Accts and Industry Relations, MaxLite

- **ENERGY STAR® Luminaires and Lamps V2.0**
  - Overview of program changes
  - Impact on Light Sources
  - Impact on Luminaires
- **California Title 24 2016 building efficiency standard**
  - What is Title 24?
  - Overview of program changes
  - Impact on Luminaires, Sources, and Applications
- **California Title 20 appliance efficiency regulations**
  - What is Title 20?
  - Overview of program changes
  - Impact on Luminaires and Light Sources

California
Title 20
Appliance Efficiency

A NOTE ON TERMINOLOGY:

Lamps
"Bulbs"

Luminaires
Light Fixtures

Portable Luminaires
Table Lamps or Desk Lamps,
typically with cord/plug

ENERGY STAR® UPDATES - LAMPS

ENERGY STAR Lamps V2.0

- The latest ENERGY STAR® Lamps specification (Version 2.0) was released on December 31, 2015 and became effective Jan. 2, 2017
- Reduced lifetime requirement on most omnidirectional LED lamps from 25,000hrs to 15,000hrs
- Omnidirectional lamp efficacy needs to be at least 80lpw (if CRI less than 90) or 70lpw (if CRI>=90).
- This means that the vast majority of **CFLs will no longer be able to be ENERGY STAR® certified starting in 2017** (many CFLs used today are approx. 65-70lpw)

IMPACTS OF ENERGY STAR® LAMPS UPDATE

Impact on LAMPS

- No more CFLs
  - ES Lamps program was started primarily to advance adoption of compact fluorescent lamps (CFLs)
  - Due to efficacy requirements of 80 lm/w on most lamps, almost all CFLs are now eliminated from the program
  - LED lamps will be primary certified products

Note: Lamps certified to a previous version are allowed to sell through stock, but they were no longer allowed to be manufactured after Jan. 2, 2017 unless they meet current specifications.

IMPACTS OF ENERGY STAR® LAMPS UPDATE

Impact on LAMPS

- LED Filament lamps can now be certified
  - Includes warmer CCTs such as 2200K
  - Requires full 6,000 hours (8.5 months) of life testing
  - Note other traditional LED lamps can certify early and be introduced to the market after 3,000 hrs of life testing

ENERGY STAR® UPDATES - LUMINAIRES

ENERGY STAR Luminaires V2.0

- The latest version of the ENERGY STAR Luminaires specification (Version 2.0) was released on May 29, 2015, and became effective June 1, 2016
- Fixtures certified to previous versions had to be recertified to V2.0 after June 1, 2016.
- **Luminaires now can be certified with a E26 socket**
- If an E26 socket is used, an ENERGY STAR certified E26 lamp must be included in the fixture
- Now luminaires can be certified if they include ANY certified lamp

IMPACT OF ENERGY STAR® LUMINAIRES UPDATE

Impact on Luminaires

- Fixtures that were previously supplied with GU24 CFLS now are likely going to be supplied with certified LED lamps or integral LED light engines

IMPACT OF ENERGY STAR® LUMINAIRES UPDATE

Impact on Light Sources

- LED Light Engines can now be certified to the Certified Subcomponent Database (CSD)
  - Allows easier ENERGY STAR certification of fixture using engines
- Lamps featuring non-traditional ANSI envelopes and shapes, GU24 base, can now be listed on the CSD
  - Lamps that do not have the familiar A, BR, B, T, etc envelope shapes can be on CSD, not ES Certified

TITLE 24 UPDATES

What is California Title 24?

Title 24 is California's building energy efficiency standards. It is required to be met for any building that requires a permit.

Lighting installations in all newly constructed buildings and additions and alterations of existing buildings must meet applicable Title 24 requirements in order to receive a permit. Compliance is verified by building inspectors.

Title 24 is updated every 3 years by the California Energy Commission (CEC), current applicable version is T24 2016. T24 2019 is currently under development.

On June 10, 2015 CEC voted to approve significant changes to California T24 2016 that became effective January 1, 2017.

TITLE 24 UPDATES

What California Title 24 is NOT:

- It is not a product certification
  - It is a building code, applicable to all buildings permitted in the state
  - Products can be used to meet the code, but there is **no such thing as a T24 compliant product**
  - It is not Title 20, which is an appliance regulation required to be met for products **sold** in the state (T20 includes portable lamps and in 2018 will include many LED lamps)
    - T24 does NOT regulate product sold in the state

SUPPORTS T24 COMPLIANCE

TITLE 24 UPDATES
SIGNIFICANT CHANGES IN TITLE 24 2016 (EFFECTIVE JAN. 1, 2017)

- All lighting installed in residential construction must be “high efficacy”
  - No longer any allowance of low efficacy luminaires (such as incandescent)
- The definition of “High Efficacy” has been significantly expanded
- Luminaires no longer need to include GU24 Sockets
  - E26 Sockets are allowed IF the luminaire includes a JA8 compliant lamp
- All luminaires must include a compliant light source
  - At the time of inspection
  - Lamps do not need to be included in the packaging with the fixture
- Light sources must be appropriately marked “JA8-2016” or “JA8-2016-E” (elevated temp/enclosed rated)

TITLE 24 UPDATES
SIGNIFICANT CHANGES IN TITLE 24 2016 (EFFECTIVE JAN. 1, 2017)

- Recessed downlights and enclosed luminaires are required to contain a JA8 compliant light source that meets elevated temp requirements
  - Marked “JA8-2016-E”
  - Note: Downlights cannot include screw base sockets
    - Downlights must also be IC/AT rated
- Builder must provide homeowner with luminaire schedule that includes lamps installed in luminaires

TITLE 24 UPDATES: TYPE OF BUILDINGS AFFECTED BY RESIDENTIAL CHANGES IN TITLE 24 2016 (EFFECTIVE JAN. 1, 2017)

- Note: Most changes in T24 2016 affect RESIDENTIAL lighting and dwellings
  - Non-Residential lighting standards remain mostly the same as T24 2013
  - Note that residential lighting requirements also apply to:
    - Single Family Buildings, indoor and outdoor lighting
    - High Rise multifamily residential units
    - Hotel and motel guest rooms
    - Fire station dwellings
    - Dormitory and senior housing dwellings
    - Sheds and garages on residential sites

TITLE 24 UPDATES:
TYPE OF INSTALLATIONS AFFECTED BY CHANGES IN TITLE 24 2016

- The Residential Lighting energy standards apply to only **permanently installed luminaires**
  - Does not apply to portable luminaires such as table lamps or freestanding floor lamps

Permanently Installed Luminaires:

Lighting that is…

- Attached to walls, ceilings and columns
- Attached to top or bottom of permanently installed cabinets
- Inside permanently installed cabinets
- Attached to ceiling fans
- Integral to exhaust fans
- Integral to garage door openers
- Part of track lighting and flexible lighting systems

***Important Note:** Permanently installed luminaires may have either plug-in or hardwired connection. A portable luminaire (contains a cord/plug) that is attached or mounted as described above, will be subject to T24 regulations.

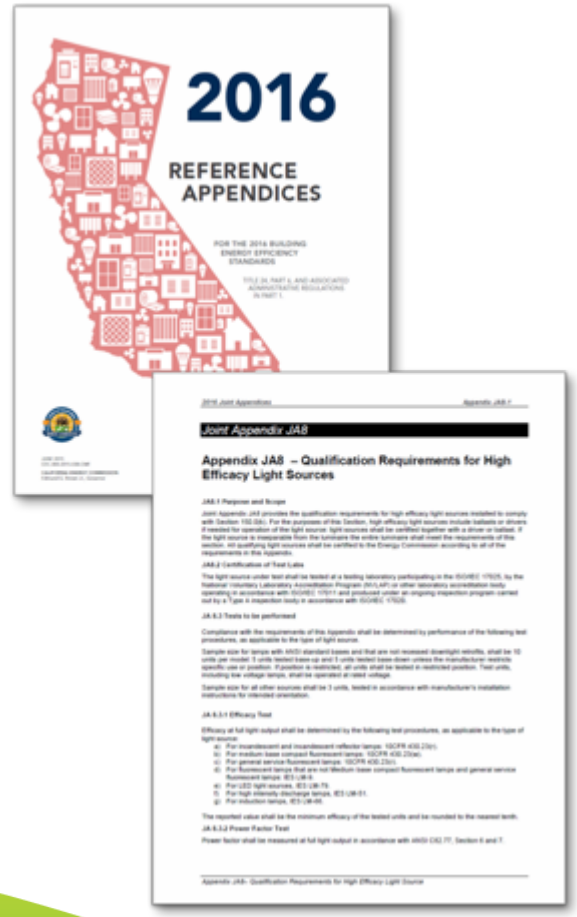
TITLE 24 UPDATES:
SIGNIFICANT CHANGES IN TITLE 24 2016 (EFFECTIVE JAN. 1, 2017)

- The new definition of High Efficacy:
- Inspectors are looking for 100% high efficacy lighting in buildings
- To be deemed high efficacy for Title 24 2016:

High Efficacy Lighting	
Light sources in this column are automatically classified as high efficacy and are not required to be JA8 compliant	Light sources in this column shall be certified to the commission as High Efficacy Light Sources and marked as meeting **JA8**
1. Pin-based linear fluorescent or CFL light sources using electronic ballasts. 2. Pulse-start metal halide. 3. High pressure sodium. **4. GU24 sockets containing light sources other than LEDs (such as CFL).** 5. Luminaires with hardwired high freq generator and induction lamp. 6. Inseparable SSL Luminaires that are installed outdoors 7. Inseparable SSL luminaires containing colored light sources that are installed to provide decorative lighting.	8. All light sources in ceiling recessed downlights. 9. GU24 sockets containing LED light sources 10. Any light source not otherwise listed in this table and certified to the commission as complying with Joint Appendix 8

Table 150.0-A
Title 24 2016 standards

TITLE 24 UPDATES: WHAT IS JA8



What is JA8?

- The primary Title 24 2016 Building Efficiency Standards documentation is approximately 289pgs
  - There is an accompanying separate Reference Appendices document of 500+ pgs
  - It contains residential appendices (RAx), non-res (NAx), and the joint appendices (JAx)
- Joint Appendix 8 (JA8) of the Reference Appendices provides all of the qualification requirements for high efficacy light sources installed to comply with section 150.0(k) of the standards
- All qualifying light sources must be certified to the state of California and registered on the California Energy Commission (CEC) database

SUPPORTS T24 COMPLIANCE JA8

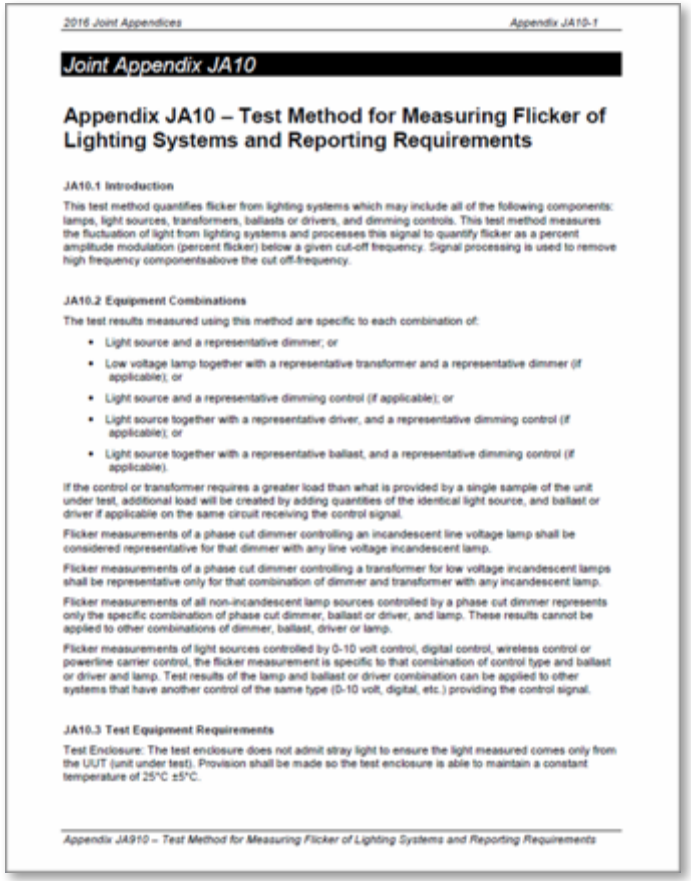
TITLE 24 UPDATES: JA8 REQUIREMENTS

- Joint Appendix 8 of the Title 24 Building Efficiency Standards

Summary of major requirements:

Efficacy	>= 45 lpw
Power Factor	>= 0.9 PF
Color Rendering	>= 90 CRI + R9>=50
CCT	<= 4000K (engines), <= 3000K (lamps)
Flicker	**< 30% for freq less than 200Hz at 100% and 20% of light output (Tested per JA10)**
Dimming	<= 10%
Testing	ENERGY STAR Elevated Temperature Life test required for all Omni Lamps (>=10W) and engines that are NOT labeled “not for use in enclosed fixtures” or “not for use in recessed fixtures”
Labeling	“JA8-2016” or “JA8-2016-E” (elevated temp test/enclosed). Exceptions for engines/lamps with dia. less than 1.0” and decorative lamps with dia. less than 2.0”

TITLE 24 UPDATES: NEW FLICKER TESTING REQUIREMENTS



2016 Joint Appendices — Appendix JA10-1

Joint Appendix JA10

Appendix JA10 – Test Method for Measuring Flicker of Lighting Systems and Reporting Requirements

JA10.1 Introduction

This test method quantifies flicker from lighting systems which may include all of the following components: lamps, light sources, transformers, ballasts or drivers, and dimming controls. This test method measures the fluctuation of light from lighting systems and processes this signal to quantify flicker as a percent amplitude modulation (percent flicker) below a given cut-off frequency. Signal processing is used to remove high frequency componentsabove the cut off-frequency.

JA10.2 Equipment Combinations

The test results measured using this method are specific to each combination of:

- Light source and a representative dimmer; or
- Low voltage lamp together with a representative transformer and a representative dimmer (if applicable); or
- Light source and a representative dimming control (if applicable); or
- Light source together with a representative driver, and a representative dimming control (if applicable); or
- Light source together with a representative ballast, and a representative dimming control (if applicable).

If the control or transformer requires a greater load than what is provided by a single sample of the unit under test, additional load will be created by adding quantities of the identical light source, and ballast or driver if applicable on the same circuit receiving the control signal.

Flicker measurements of a phase cut dimmer controlling an incandescent line voltage lamp shall be considered representative for that dimmer with any line voltage incandescent lamp.

Flicker measurements of a phase cut dimmer controlling a transformer for low voltage incandescent lamps shall be representative only for that combination of dimmer and transformer with any incandescent lamp.

Flicker measurements of all non-incandescent lamp sources controlled by a phase cut dimmer represents only the specific combination of phase cut dimmer, ballast or driver, and lamp. These results cannot be applied to other combinations of dimmer, ballast, driver or lamp.

Flicker measurements of light sources controlled by 0-10 volt control, digital control, wireless control or powerline carrier control, the flicker measurement is specific to that combination of control type and ballast or driver and lamp. Test results of the lamp and ballast or driver combination can be applied to other systems that have another control of the same type (0-10 volt, digital, etc.) providing the control signal.

JA10.3 Test Equipment Requirements

Test Enclosure: The test enclosure does not admit stray light to ensure the light measured comes only from the UUT (unit under test). Provision shall be made so the test enclosure is able to maintain a constant temperature of 25°C ±5°C.

Appendix JA910 – Test Method for Measuring Flicker of Lighting Systems and Reporting Requirements

- Test method for flicker requirements in T24 2016 are described in Joint Appendix 10 **(JA10)**
- All qualifying light sources are required to complete the testing as described and meet <30% flicker for frequencies of 200Hz or below, at 100% and 20% light output
- Test must be performed at a lab accredited by NVLAP or accreditation body operating in accordance with ISO/IEC 17011

TITLE 24 UPDATES: T24 2016 IMPACT ON LUMINAIRES

- Manufacturers of luminaires for new construction need to make sure JA8 compliant lamps are available for the socketed fixtures that are sold for new construction
  - Example: If you are a manufacturer of a luminaire that includes a G9, E12 candelabra, GU5.3, GU10, or other socket not quite as widely in use as medium base screw sockets, care must be taken to ensure the homebuilder is not stuck with a luminaire that can't possibly be installed to meet T24 standards.

Are there JA8 compliant versions of these lamps available for the installation?

TITLE 24 UPDATES:
WHAT JA8 COMPLIANT LAMPS ARE AVAILABLE TODAY?

List online on:
https://cacertappliances.energy.ca.gov

TITLE 24 UPDATES:
WHAT JA8 COMPLIANT PRODUCTS ARE AVAILABLE TODAY?

List online on:
https://cacertappliances.energy.ca.gov

(As of 3/1/17)

- **2,185** JA8 2016 Compliant inseparable luminaires and light sources
  - 47 manufacturing companies
  - 67 brands
  - Product Types:
    - Inseparable Luminaires: **1,912** models
    - Omnidirectional Lamps: **42** models
    - Directional lamps: **156** models
    - Light Engines: **69** models
    - Decorative lamps: **6** models

TITLE 24 UPDATES:
T24 2016 IMPACT ON LUMINAIRES

- Some manufacturers are deciding to put the JA8 compliant lamps in the box with the fixture
  - Eases installation and hassle for home builders
  - Ensures the proper type of lamp is installed in each fixture
- Some manufacturers are deciding to produce separate luminaire SKUs with included compliant light sources just for California new construction market
- Retailers may need to educate luminaire purchasers that intend to use products for permitted construction that they need to be sure to select code-compliant luminaires

TITLE 24 UPDATES:
T24 2016 IMPACT ON LUMINAIRES

- **Outdoor Residential Luminaires**
  - All outdoor lighting must be high efficacy
  - If the outdoor luminaire is a SSL Inseparable Luminaire, it automatically is deemed a "High Efficacy" luminaire
  - All outdoor lighting for single family homes is still required to be controlled by one of the following combinations:
    1. Photocell and motion sensor
    2. Photocell and time switch
    3. Astronomical time clock
    4. EMCS with features of astronomical time clock, does not allow the luminaire to be on during day, may be programmed for auto off at night

*__Note__: Lighting that is NOT attached to a building on a single-family site is NOT regulated by the state (such as landscape lighting)

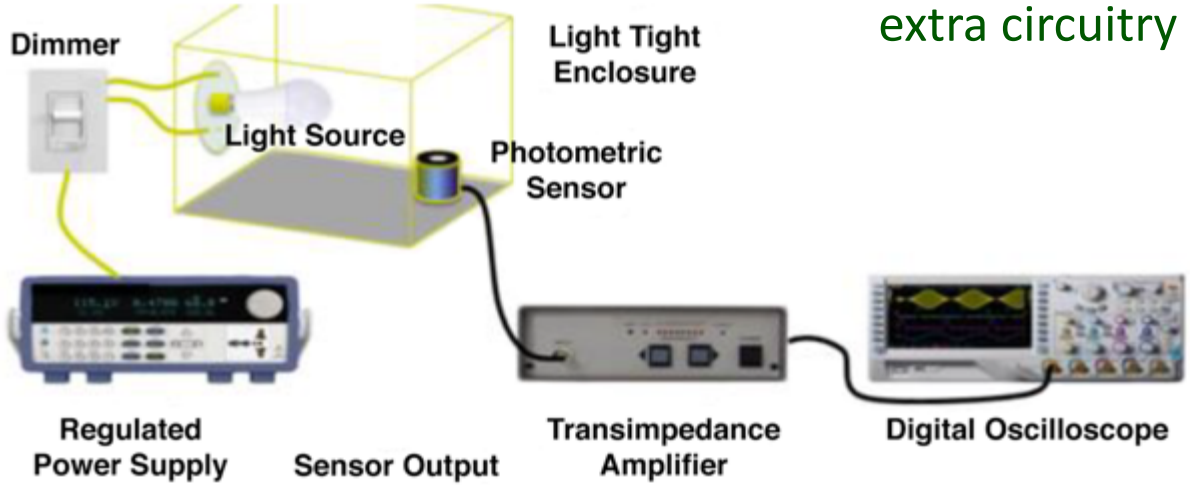
TITLE 24 UPDATES:
T24 2016 IMPACT ON LUMINAIRES

- Luminaires that utilize LED Light Engines are required to register items on CEC database
  - This type of luminaire is referred to by the state as an Inseparable SSL Luminaire
  - Note that luminaires with sockets do NOT have to be registered
- The engines must be tested and labeled as JA8-2016 or JA8-2016-E
  - Special flicker testing required
  - High CRI engines
  - Dimmable
  - Only CCTs that are <= 4000K allowed
- If the engine is made to be removable, then 6,000 hours of life testing is needed.
  - If engine is inseparable, the LM80 data of the chip can be used
  - May limit the manufacturer's design choices to ease replaceability for customer

TITLE 24 UPDATES:
T24 2016 IMPACT ON LAMPS

- Lamp manufacturers must create entirely new SKUs for Title 24
- These lamps are specifically designed an labeled to be JA8 compliant
  - Utilizes more expensive and not as widely-available high color rendering LED chips
    - Chips must be >= 90CRI with R9>= 50
      - R9>=50 ensures high red color rendering in the chips
- Lamps must be tested for 6,000 hours for lifetime specs
  - 8.5 months of testing, long lead time for market intro

TITLE 24 UPDATES:
T24 2016 IMPACT ON LAMPS



- Costly and time-consuming testing for new <30% flicker metrics
- Electronics for flicker and dimming requirements place limitations on miniaturizing lamp designs
  - Some smaller lamps are quite difficult to design with extra circuitry to meet flicker and dimming metrics

WHAT IS CALIFORNIA TITLE 20?

Title 20 is California's appliance efficiency regulations.

Manufacturers must certify regulated products to the California Energy Commission prior to being sold or offered for sale in the state of California

Failure to certify products can result in fines of up to $2,500 per non-compliant item.

Title 20 has no set schedule for updates, and is not updated according to a regular cycle. However, the T20 document is updated roughly every year to ensure that changes to the Federal standards are incorporated.

On Jan. 27, 2016 CEC voted to approve significant changes to lighting products in T20 2016 that will become effective January 1, 2018.

APPLIANCES REGULATED UNDER TITLE 20 2016

Partial list of products covered under Title 20:

- Refrigerators, freezers
- Air Conditioners
- Gas space heaters
- Water Heaters
- Gas pool heaters
- Plumbing Fittings
- **Fluorescent lamp ballasts**
- **Lamps**
- Emergency lighting
- Traffic signal modules/lamps
- **Luminaires**
- Dishwashers
- Clothes washers
- Cooking products
- Electric motors
- Low voltage transformers
- Power Supplies
- Televisions, Consumer A/V equipment
- Battery charger systems

All state regulated products are required to be certified and registered in CEC database

LUMINAIRES REGULATED UNDER TITLE 20 2016

- Metal Halide luminaires
  - Minimum efficacy required
- Undercabinet Luminaires
  - Only applicable to T8 fluorescent lamps attached to office furniture
  - Min. ballast efficacy required, except dimmable ballasts
- Portable Luminaires

PORTABLE LUMINAIRE REQUIREMENTS UNDER TITLE 20 2016

(for all luminaires manufactured on/after Jan. 1, 2010)

Requirements (must meet at least one):

1. Dedicated fluorescent lamp socket connected to high freq. electronic ballast within the portable luminaire
2. Be equipped with GU24 socket and NOT rated for use with INC lamps
3. Be an LED luminaire or portable luminaire with an LED Light Engine with integral heat sink and comply with table N-2

Table N-2 Requirements for portable luminaires with LED Light Engines

Criteria	**Requirement**
Light Output	200 lm
Min. LED Luminaire efficacy	29 lm/w
Min. LED Light Engine efficacy	40 lm/w
Correlated Color Temp (CCT)	2700K to 5000K
Min. Color Rendering Index (CRI)	75 CRI
Power Factor (for luminaires labeled or sold for residential use)	0.7 PF

PORTABLE LUMINAIRE REQUIREMENTS UNDER TITLE 20 2016

(for all luminaires manufactured on/after Jan. 1, 2010)

Requirements (must meet at least one):

4. Be equipped with E12, E17, or E26 base and …
   - Pre-packaged and sold together with one screw-base CFL or LED lamp for each socket
     - CFL or LED lamp must be compatible with luminaire controls
     - CFLs must meet ENERGY STAR lamp efficacy of Dec. 31, 2008
       - (50 to 65 lm/w)
     - **LED lamps must meet min. requirements of current T20**
5. Be equipped with one or more single-ended non-screw base halogen lamp sockets (line or low voltage), dimmer control or hi/low controls, and be rated for a max of 100W

***Note**:
- Exceptions for art work luminaires and portable wall mount adjustable luminaires with max 24” articulated arm.
- Portable luminaires with internal power supplies must have zero standby power when luminaire is off

NEW LAMPS REGULATIONS UNDER TITLE 20 2016

Starting in 2018, California has new statewide requirements for the following lamp types:

- **State-Regulated LED lamps**
  - Includes LED lamp bases: E12, E17, E26, GU24, incl retrofit kits for cans with these same bases
    - Does NOT include lamps ≥ 2,600 lm or lamps that cannot provide light with CCT between 2200K and 7000K
- **State-regulated Small Diameter Directional Lamps**
  - Includes pin base and E26 base
  - Includes MR16, MR11, Par, R type with dia. ≤ 2.25”
    - Only lamps with lumen output ≤ 850 lm or rated wattage of 75W or less and has rated life greater than 300 hrs

Note: These lamps have not been previously regulated by the state of CA, new regulations start Jan. 1, 2018

NEW LAMPS REGULATIONS UNDER TITLE 20 2016

State-regulated LED lamps manufactured on/after January 1, 2018
with output ≥ 150lm (E12 base) or 200lm (other base)

- CRI ≥ 82
  - R1 through R8 values ≥ 72
- PF ≥ 0.7
- Rated Life ≥ 10,000 hrs
- Minimum efficacy compliance score per table K-14 below

Effective date	Min. Compl Score	Min. Efficacy
January 1, 2018	282	68 lm/w
July 1, 2019	297	80 lm/w

Example:

68 lm/w + (2.3 x 90 CRI) => 275 compl score FAIL
75 lm/w + (2.3 x 90 CRI) => 282 compl score PASS

Starting **January 1, 2018**, state-regulated LED lamps will be required to be certified and registered in CEC database

NEW LAMPS REGULATIONS UNDER TITLE 20 2016

State-regulated Small Diameter Directional lamps manufactured on/after January 1, 2018

- Rated Life ≥ 25,000 hrs and…
- Minimum efficacy of 80 lm/w

  or
- Minimum efficacy of 70 lm/w and Compliance Score ≥ 165
  - Compliance Score = Efficacy + CRI

Example:

70 lm/w + 90 CRI => 160 compliance score FAIL
75 lm/w + 90 CRI => 165 compliance score PASS

Note: These new requirements will eliminate most INC and halogen MR11, MR16, GU10, R/Par16 lamps in favor of LED

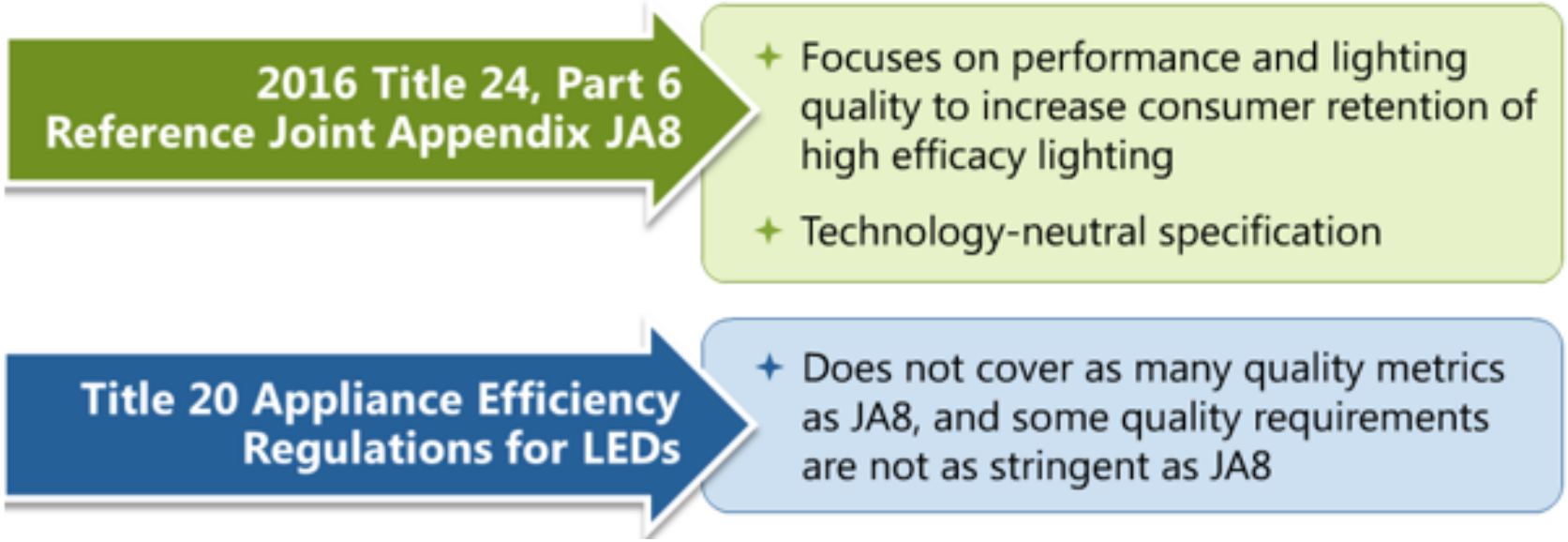
IMPACT ON PORTABLE LUMINAIRES WITH SOCKETS?

Item	Luminaire Registration	Lamp Registration Today	Lamp Registration Jan 1, 2018
Portable Luminaire with E26 **CFL** 	Luminaire must be registered with state	CFL must meet Federal and State Requirements. Registered with both DOE and CEC	CFL must meet Federal and State Requirements. Registered with both DOE and CEC.
Portable Luminaire with E26 **LED lamp** 	Luminaire must be registered with state	None required (no Federal or State regulation)	LED lamp must meet State Requirements. Registered with CEC.

Note: T20 also includes marking guidelines, must show Date of Manufacture. Effective date is per manufacturing code

JA8 COMPLIANT LAMPS VS T20 LAMPS IN 2018

JA8 compliant lamps, since requiring more stringent specifications, should all meet T20 requirements in 2018. Note the lamps will not only need to be registered in JA8 database, but also will need to be registered in the CEC database under State-Regulated LED lamps in 2018.



Note: T20 requires labs performing tests to be approved by California Energy Commission, T24 does not

FOR MORE INFO ON ENERGY STAR®, TITLE 24 & TITLE 20:

- **For more info on ENERGY STAR®:**
  - Lamps: www.energystar.gov/lamps
  - Luminaires: www.energystar.gov/luminaires

- **For more info on California Title 24 2016**
  - http://www.energy.ca.gov/title24/

- **For more info on California Title 20**
  - http://www.energy.ca.gov/appliances/

THANKS FOR WATCHING!

QUESTIONS/ANSWERS

Thank you everyone for your attention! Please feel free to use this opportunity to ask any questions you may have about MaxLite or the products shown in this presentation.

FOR MORE INFORMATION ABOUT OTHER MAXLITE PRODUCTS, OR FOR LIGHTING QUESTIONS IN GENERAL; PLEASE CONTACT:

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